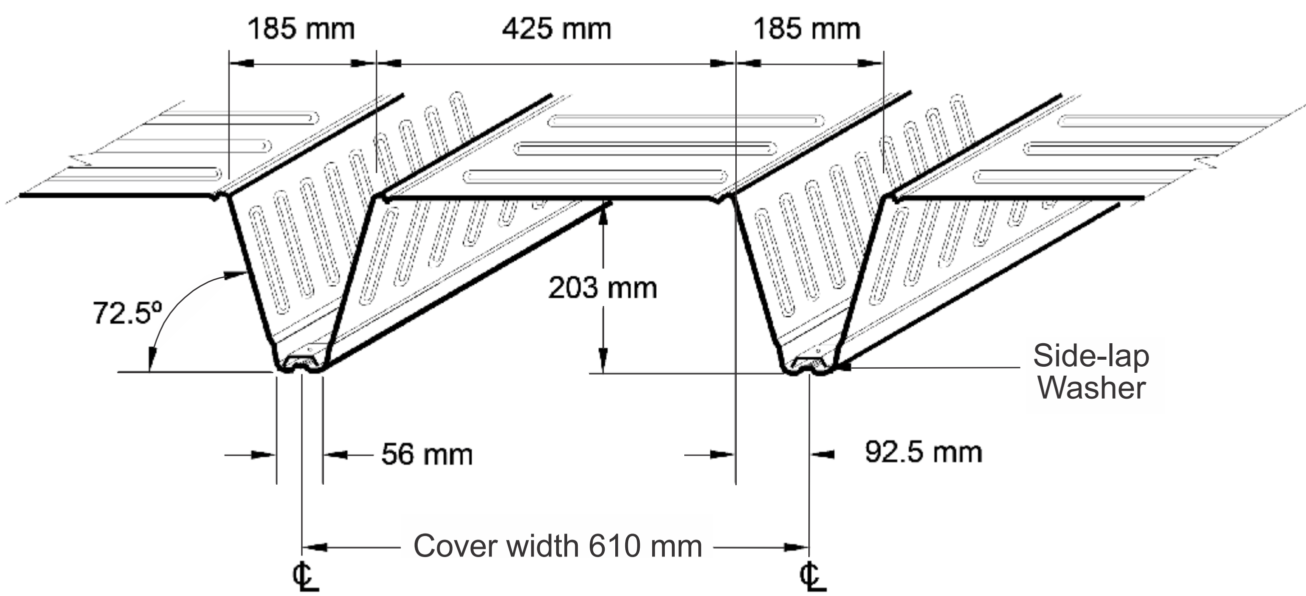
DESIGN CRITERIA AND TECHNICAL DATA

This catalogue provides technical and structural information for the ComSlab® composite concrete slab system. All calculations, whenever applicable, were based on CSA Standard S136 and CSSBI documents. Design load tables are also presented, as well as various construction applications to assist the designer in detailing common structural assemblies. Additional assistance regarding the ComSlab® Composite Floor System construction method may be obtained by contacting the Bailey Metal Products sales office in your area.

The structural load tables and technical information contained in this catalogue were prepared by Dr. R.M. Schuster, P.Eng., Professor Emeritus of Structural Engineering at the University of Waterloo.

ComSlab® CROSS SECTION PROPERTIES



IMPERIAL UNITS

Base Steel Thickness (in.)	Profile Depth (in.)	Profile Weight (psf)	A_g[1] (in.^{2}/ft.)	A_e[2] (in.^{2}/ft.)	S_p[3] (in.^{3}/ft.)	I_x[4] (in.^{4}/ft.)
0.0375	8.00	2.58	0.727	0.297	0.690	3.41
0.0495	8.00	3.41	0.960	0.444	1.287	5.62

SI METRIC UNITS

Base Steel Thickness (mm)	Profile Depth (mm)	Profile Mass (kg/m^2)	A_g[1] (mm^2/m)	A_e[2] (mm^2/m)	S_p[3] (10^3mm^3/m)	I_x[4] (10^6mm^4/m)
0.953	203	12.60	1539	628	37.00	4.65
1.257	203	16.60	2031	940	69.10	7.66

TABLES NOTES

[1] A_g = Gross cross sectional area of profile per unit width.

[2] A_e = Effective cross sectional area of profile per unit width.

[3] S_p = Effective section modulus of profile per unit width for positive bending.

[4] I_x = Effective moment of inertia of profile per unit width.

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DESIGN CRITERIA

MATERIALS

- Steel deck meets the requirements of **ASTM A653** Standard Specification of Steel Sheet, Zinc-coated (Galvanized) by the Hot-dip Process, Structural (Physical) Quality. The guaranteed minimum yield strength is **345 MPa (50 ksi)** with a minimum zinc coating mass of **275 g/m^2 Z 275 (G90)** total both sides. Steel deck base thickness is **0.953 mm (0.0375 in.)** or **1.257 mm (0.0495 in.)**.
- Reinforcing steel meets the requirements of **CSA G30.18-09**. Guaranteed minimum yield strength is **400 MPa (58.0 ksi)**. The clear distance of each reinforcing bar from the bottom of the steel deck is **40 mm (1.57 in.)**.
- Concrete is assumed to have a minimum cylinder strength of **30 MPa (4.35 ksi)**, with a maximum aggregate size of **20 mm (0.75 in.)**. Normal density structural concrete is **2400 kg/m^3 (150 lb/ft^3).**

LIMIT STATES DESIGN (LSD)

- **Strength** – Limit states design principles were used in the development of the structural load tables, i.e., the factored resistance under consideration, **ΦR ≥ the effect of the factored loads.** This is in accordance with the National Building Code of Canada, 2005. Since the self weight of the steel deck and the concrete have already been included in the structural load tables, the maximum specified load (from the appropriate structural table) shall be: **>(LL + 1.25/1.5DL)**, where:

  LL – Specified live load
  DL – Specified superimposed dead load
  1.25 – Dead load factor
  1.5 – Live load factor

- **Serviceability** – If deflection controls, the maximum specified load (from the appropriate structural table) shall be: **≥(LL + DL)**.

SECTION PROPERTIES OF STEEL DECK

All structural section properties of the steel deck were calculated in accordance with **CSA Standard S136-07**. See page 5 for section properties and cross section details.

STRUCTURAL LOAD TABLES

The structural load tables provide maximum specified loads and were established in accordance with **CSSBI 12M-2008** and **CSSBI S3-2008**.

- **Shoring During Construction**
  Shoring requirements for the steel deck during construction were established in accordance with **CSSBI 12M-2008**. The following strength and deflection criteria were used:
- **Strength** – Calculations were based on the combined loads due to the wet concrete, the steel deck and certain construction live loads. Minimum construction live loads applied separately are:

  1) **1 kPa (21 psf)** uniform load.
  2) **2 kN/m (137 lb/ft)** transverse line load at the centre of the span.

- **Serviceability** – Calculated deflections were based on the uniform load of concrete slab and steel deck, and the maximum deflections were limited to **L/180 or 20 mm (0.787 in.)**.

  Presented in the ComSlab® composite slab load tables are two maximum unshored span conditions, as follows:

  1) Maximum Unshored Span – based on the above stated strength and serviceability criteria.
  2) Maximum Unshored Span – based on the above stated strength and serviceability criteria, except a **2 kPa (42 psf)** uniform load was used instead of **1 kPa (21 psf)**. This was done because in some jurisdictions a **2 kPa (42 psf)** uniform live load is required.

At the top of each structural load table, two maximum unshored span conditions are given. Using this information, one can determine the number of shores required for any given span condition.

- **Load Tables** – Both the strength and deflection criteria were considered in accordance with **CSSBI S3-2008**, as follows:
- **Strength** – Flexure was the only criteria that was considered in the calculations, since shear-bond is not a mode of failure. In accordance with Table 4.1.5.9 of the National Building Code of Canada, 2010, a **9 kN (2023 lb)** specified concentrated live load was included in the strength calculations.
- **Serviceability** – The calculated deflections due to specified superimposed loads (LL + DL) were based on a uniform load with the maximum deflection limited to **L/360**. The modular ratio for normal density concrete was taken as **10** and the moment of inertia is the average of the uncracked and cracked moment of inertias. For use of the deflection parameter, DP, see example on page 7. To determine the deflection due to the slab weight, also see page 7.
- **Use of Load Tables** – Please see example on page 7 for use of structural tables.

STRUCTURAL TESTING

Structural ComSlab® composite slab tests were carried out at the University of Salford, England by Prof. D. O'Leary (April, 1993). Based on these tests, shear-bond was not a mode of failure. Typically, composite slab systems fail in shear-bond. However, since the ComSlab® composite slab system also has reinforcing steel, shear-bond is not a governing failure mode.

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ComSlab® EXAMPLE (IMPERIAL UNITS)

Given the following information, check the adequacy of the ComSlab® floor system:

Given:

Yield Stress: F_y = 50.0 ksi for shoring requirements

F_y = 40.6 ksi for composite strength requirements

Single span length = 24.5 ft.

Fire rating required = 1 hr.

Reinforcing steel bar yield strength = 58 ksi

Concrete – Normal density = 150 lb/ft^2

<u>Specified Loads</u>

Superimposed dead load (DL)

a) floor finish = 10.5 psf

b) partitions = 20.0 psf

Total superimposed DL = 30.5 psf

Live load (LL) = 100.0 psf

Total Load = $\{\frac{1.25}{1.5}(DL) + LL\} = \{(0.833)(30.5) + 100\} =$ **125 psf**

Use of load table :

From the appropriate table on page 24, use 0.0375" steel deck thickness, 30 mm rebar diameter at 10.5 in. slab thickness and 24.5 ft. span. The maximum specified load is 138 psf, which is controlled by deflection and is checked as follows:

(DL + LL) = (30.5 + 100) = 130.5 psf

<u>Since 138 > 130.5 OK</u>

NOTE: Maximum unshored span is 14.3 ft.: one shore support is required at mid span.

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USE OF DEFLECTION PARAMETER

imperial Units

$$w_d = \frac{DP \times 10^6}{DC \times (L)^3}$$

SI Units

$$w_d = \frac{DP \times 10^3}{DC \times (L)^3}$$

Where:

w_d = Maximum specified deflection load in **kPa** or **psf**,

DP = Deflection parameter from load table,

DC = Deflection constant such as 360,

L = Span length in **metres** or **feet**

Examples:

Base steel thickness – 0.953 mm

Nominal bar diameter – 30 mm

Slab depth – 260 mm

Span length, L, – 8 m

From table on page 36, DP = 918

Assume DC = 360

$$w_d = \frac{918 \times 10^3}{360 \times (8)^3} = \underline{4.98\text{ kPa}}$$

Base steel thickness – 0.0375 in.

Nominal bar diameter – 25 mm

Slab depth – 10.5 in.

Span length, L – 25 ft

From table on page 23, DP = 668

Assume DC = 400

$$w_d = \frac{668 \times 10^6}{400 \times (25)^3} = \underline{107\text{ psf}}$$

For DC = 360, w_d = 119 psf

NOTE: For confirmation of values, see appropriate load tables.

DEFLECTION DUE TO SLAB WEIGHT

The deflection due to the slab weight can be calculated as follows. The calculation is based on the uncracked moment of inertia of the section and the deflection parameter, SWDP, can be obtained from the load tables.

Imperial Units

$$\delta_{sw} = \frac{SWDP \times (L)^4}{10^6} = \text{in.}$$

L = feet

SI Units

$$\delta_{sw} = \frac{SWDP \times (L)^4}{10^3} = \text{mm}$$

L = metres